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USER'S GUIDE FOR THE UPDATED SMITH-FEDDES MODEL

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This user's manual for the Smith-Feddes Update provides to the user's non-ADP personnel the information they need to use the system effectively.

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SECTION 1 GENERAL

1.1 Purpose of the Users Manual

The objective of the Users Manual for Smith-Feddes Update (Contract No. N00228-84-C-3157) is to provide the user's non-ADP personnel with the information necessary to effectively use the system.

1.2 Project References

The original references for design and implementation of the Smith-Feddes model are:

Feddes (1973),

Smith (1974) and

Feddes (1974).

References dealing with conversion of the computer code from COBOL-FORTRAN to FORTRAN IV are Dykton et al. (1984) and Brown (1983). The reference dealing with RTNEPH data format is AGFWC/TSIT (1983).

The revisions made to the S-F computer code, so that it would accept the RTNEPH cloud data format instead of the 3DNEPH cloud data format, are described in the Final Report to this contract (Rogers et al., 1985). These revisions included Calspan's design, coding and implementation of many input subroutines which are described in Section 2.4.2 of this User's Guide. In addition, this computer program implements the updates, corrections and recommendations to the cloud microphysics which resulted from Calspan's examination of the microphysics parameterizations used in the model.

This S-F program uses height of cloud base and top, cloud type, cloud cover percentage, presence of precipitation and vertical profiles of temperature and pressure to provide vertical profiles of cloud condensed moisture content (CMC) and the distribution of cloud particle number concentration by particle size. When precipitation is present, the same information is provided for the precipitation, both in-cloud and below cloud base to the ground.

The project sponsor was the Naval Environmental Prediction Research Facility. The modified S-F program will be used by the Naval Surface Weapons Center and will be run by Fleet Numerical Oceanography Center.

1.3 Terms and Abbreviations

The following terms and definitions are unique to this document:

1.) RTNEPH (Real Time NEPHanalysis) - This term applies to the global cloud analysis prepared at Air Force Global Weather Center (AFGWC) and to the RTNEPH magnetic data tape which contains the output of this cloud analysis which, in turn, is used as input to the S-F model.

2.) Condensed Moisture Content (CMC (g/m^3)) - This quantity is the main microphysics measure of moisture content in the S-F model. If no precipication is present, CMC is the same as the

cloud moisture content. If precipitation is present, CMC is the total condensed moisture, precipitation plus cloud.

There has been some confusion in the S-F model about the definition of the terms layer and level. We made the following definitions, which are consistent with S-F design, for this computer program.

Cloud deck - This is the total, geometric vertical depth occupied by any given cloud type.

Layer - The cloud deck is composed of one or more geometric cloud layers in the vertical, where the definition of the heights of the boundaries of the layers is unique to the Smith-Feddes model design.

Level - Level is used to designate cloud types as low, middle and high level clouds, such as stratocumulus (low), altostratus (middle) and cirrus (high), respectively.

1.4 Security

N/A

SECTION 2. SYSTEM SUMMARY

2.1 System Application

The purpose of the Smith-Feddes computer program is to provide vertical profiles of cloud and precipitation moisture content and the corresponding distribution of cloud particle concentration by cloud particle size from observations of cloud depth, cloud type, cloud coverage and vertical profiles of temperature and pressure.

The input to the system is the cloud information prepared by AFGWC via its RTNEPH program and presented on magnetic tape for 25 x 25 n mi square areas, the total set of which cover the earth's surface.

The S-F computer program contains the capability for unpacking the RTNEPH tape data into CDC 60-bit words. The program contains code for computing cloud water generated during adiabatic rise of cloud parcels. In addition, the program obtains its vertical profiles of temperature and pressure from the FNOC library (APLIB) program called PNTDAT.

2.2 System Operation

NSWC will initiate a request for the output from the Smith-Feddes model for a data point defined by latitude and longitude at a particular date and time. The appropriate RTNEPH data tape for that date and time is submitted as input. The PNTDAT program provides the temperature and pressure profile for

the data point at the requested date and time. Currently, PNTDAT provides temperatures and pressures from only the most recent FNOC global weather analysis cycle. The terrain tape is the same for all program runs.

Alternatively, any or all of the above information may be input via cards. This capability provides for input of temperature and pressure vertical profiles from sources other than PNTDAT. In addition, this capability removes the requirement for reading and unpacking the RTNEPH and terrain tapes for any subsequent reruns of the program for observed conditions at a data point (see Fig. 1b). Selection of the tape or the card input mode is made via control variable values set through card input (see Fig. 1).

Since the input data are representative of conditions in a 25 x 25 n mi square, the cloud cover percentage is interpreted as the probability of encountering the S-F CMC values. Previously, the output CMC values represented the full CMC values multiplied by the cloud cover percentage.

The phase of the CMC (water or ice) is treated as follows. For noncirriform clouds, CMC is all liquid at temperatures above 0° C and all ice below -40° C. In between these temperatures, CMC is reported as liquid and the model provides the probability that the cloud water will be all liquid; it does not provide the respective percentages of liquid and ice in the cloud. CMC is ice for all cirriform clouds.

The remaining output is the distribution of cloud particle number concentration by particle size. For

noncirriform clouds in which the temperature is greater than -40°C, the model provides the cloud droplet distribution. Cirriform clouds are all ice crystals.

If precipitation is present, the model provides the above parameters for precipitation in addition to clouds, except that precipitation is ice below 0° C and liquid above 0° C.

2.3 System Configuration

The computer used is the CDC machine, code named HAL, at FNOC. The S-F input is card image, free format for latitude and longitude, and 9 track, 1600 BPI magnetic tape for the RTNEPH and Terrain tapes. Output is printed. Input to PNTDAT is card image in directive format. Output from PNTDAT is card images on a temporary disk file called TAPE7, which is then read by the Smith-Feddes program.

Alternatively, both of the tape inputs and the temperature and pressure vertical profiles may be input in card format (see Fig. 1b).

2.4 System Organization

The Smith-Feddes computer program consists of a MAIN program and its associated subroutines (S/R). The subroutines fall into three main classes, input, data processing and output. The subroutines and their main functions are discussed below.

2.4.1 Main Program Segment

MAIN

MAIN is the controlling program which calls input driver, S/R RDINPT, calls the data processing driver, S/R FTN75C, and calls the output driver, S/R WRTOUT. MAIN also prints out for

reference various input fields before they are passed to the microphysics processing portion of the code.

2.4.2 Input Segment of the Code

S/R RDINPT

S/R RDINPT is the input driver which in turn calls S/R's RTNPH, RTTERR and RDTEMP.

S/R RTNPH

RTNPH reads the latitude and longitude of the geographic point for which the S-F output is required. This latitude and longitude is converted to box, row, column and grid point coordinates of the RTNEPH northern hemisphere data tape. Next the data for the desired grid point is located on and read from the RTNEPH data tape and is unpacked using FNOC S/R BRPK. For each cloud deck present (up to a maximum of four) the RTNEPH cloud type numerical code is converted to the 3DNEPH cloud type numerical code (which is the code that the microphysics processing program is controlled by). The heights of the cloud deck base and top are decoded into heights above mean sea level in meters. The cloud cover percentage is also extracted. If the top of a lower cloud deck is located above the base of the next higher cloud deck, an average of these two heights is obtained, and then it replaces both these other two heights.

S/R's RTTERR, RDELEV, and HTMOD

S/R RTTERR first calls S/R RDELEV which locates the elevation data for the grid point on the Terrain tape, unpacks the data using FNOC S/R's BRPK and BXMT, and then produces the terrain elevation in meters. S/R RTTERR specifies the geometric

heights of the cloud layers as originally defined for the 3DNEPH cloud input format. S/R HTMOD then modifies these 3DNEPH heights to reflect the RTNEPH observed cloud base and top heights which were obtained in S/R RTNPH.

S/R RDTEMP

S/R RDTEMP proceses the currently observed temperature and pressure vertical profiles at the gridpoint (obtained from FNOC program PNTDAT) to provide pressure and temperature values for the RTNEPH geometric cloud layers generated in S/R RTTERR. Pressure is computed for the base of the geometric layer and temperature is computed for the base and midpoint of the layer. Provision is made to calculate surface pressure even when the surface height is located between the heights of standard pressure levels.

Upon completion of the S/R RDTEMP, all input and preprocessing of input is complete and the microphysics processing is then initiated. With the exception of MAIN and RDINPT, all the S/R's described so far were Calspan designed, written and coded to implement the modification of the S-F computer code to handle the RTNEPH input format. The S-F microphysics code was modified primarily to implement the corrections, recommendations and decisions which were arrived at as a consequence of the examination of the microphysics parameterizations in the S-F model.

2.4.3 Microphysics Segment of the Code

S/R FTN75C

S/R FTN75C is a data transfer and subroutine calling program. This program calls S/R NEPHS and S/R LWC which are described below.

S/R NEPHS

S/R NEPHS basically transfers the cloud input data from input arrays to COMMON arrays which are used by the microphysics portion of the computer code.

S/R LWC

S/R LWC is the first program in a series of nested, sequentially-called subroutines which perform the microphysics processing of the S-F model. The level of the cloud type (low, middle, high or cumulonimbus), the index number of the bottom layer and top layer which contain the cloud deck, and the total geometric depth of the cloud are determined. These parameters are all key pieces of information used to control the subsequent microphysics processing. S/R LWC then calls S/R LW.

S/R LW

S/R LW indexes through all the cloud layers occupied by a given cloud type. The subroutine obtains cloud condensed moisture content (CMC) either by calling the adiabatic computation of CMC routine (S/R AL) or by using the revised CMC versus temperature table of the S-F model. If the adiabatic route is taken, S/R LW computes control variables from which S/R AL obtains the adiabatic CMC at the midpoint of successively higher cloud layers, if the cloud deck encompasses more than one

layer. S/R LW also locates the maximum in CMC at 80% of the cloud depth for convective cloud types, and prepares the CMC to be modified in S/R DSD when precipitation is present. S/R LW also computes the probability that the CMC will be all water when the cloud layer midpoint temperature is between 0 and -40°C.

S/R AL

S/R AL computes the condensed moisture produced by moist adiabatic ascent from cloud base. The computation is carried out in 100m steps or a fraction thereof until the midpoint of the cloud layer is reached. If the cloud deck encompasses more than one cloud layer, the computation is continued from the current midpoint up to the bottom of the next higher layer. The adiabatic CMC and temperature computed at the bottom of the next higher layer are returned to S/R LW so that they will be available when S/R AL is called for the next higher cloud layer. S/R AL calls S/R TZ which computes the moist adiabatic lapse rate at the bottom of each 100m sublayer.

S/R DSD

After S/R LW has processed the CMC for a given cloud layer, it then calls S/R DSD. S/R DSD provides the CMC for both cloud and precipitation in either water or ice type clouds with or without precipitation. The various types of CMC are then provided as input to a series of calls of S/R NDROPS.

S/R NDROPS

S/R NDROPS computes the number of drops or ice crystals by one micron radius intervals for various cloud types using the parameterized equation described in the contract Final Report

(Rogers, et.al., 1985). The parameters have been corrected or modified per Calspan's examination of the S-F drop-size distribution parameterization.

2.5 Performance

The Smith-Feddes model processes observed cloud conditions and temperature and pressure profiles from a single geographical location to provide profiles of condensed moisture content and drop size (particle size for ice clouds) distributions. The performance measures and information of interest for this model are as follows:

a.) Input: The geographic location is specified by latitude and longitude on card input. The cloud information is contained on the RTNEPH magnetic data tape. Terrain information is on a terrain data tape. Temperature and pressure profile information is contained on a disk file created as output from FNOC program PNTDAT.

b.) Output: Output is printed output of the profiles of CMC and dropsize distributions.

c.) Response time: N/A.

d.) Limitations: The programs size of 51700 octal satisfies FNOC's 110000 octal memory limitation. The program is written in Fortran 4.6.

e.) Parity errors on tape read are noted.

f.) On current HAL machine, CDC CYBER 855, 35.545 seconds of execution time of which S-F execution

time is .087 seconds, PNTDAT execution time is .373 seconds, and the rest is tape read time.

g.) The program could be expanded to process several geographic locations, which are located around a PNTDAT latitude-longitude grid point, by inserting an appropriate DO LOOP in program segment MAIN and by bypassing the input of PNTDAT for subsequent grid points.

h.) N/A

2.6 Data Base

N/A

2.7 General Description of Inputs, Processing and Outputs

a. Inputs

Latitude and longitude of the geographical location for which output is to be obtained is supplied by the user of the program. Thee data are supplied both to the PNTDAT program and to the Smith-Feddes Program, but in different formats. Input to the PNTDAT program can be found in Appendix A and in the write up of PNTDAT at FNOC. For the SF program, longitude is positive eastward, thus 110W is 250.

The PRCCDE Control Variable determines whether the drop size distribution calculations are to be made or not; 0 to compute, 1 not to compute.

o Terrain Elevation

The terrain elevation is required to set up the height (above mean sea level) of the basic geometric cloud layers, some of which are defined relative to ground elevation.

All geometric heights need to be above msl since the cloud height information is reported in these units. The source of terrain height is the Air Force Terrain Geography Tape (Northern Hemisphere, 9 track, 1600BPI, packed); see Appenix B.

o <u>Temperature and Pressure Profiles</u>

These data are needed to compute the CMC for the adiabatic approach or to extract the CMC from the S-F table of CMC versus temperature. The temperature is also needed to specify the probability that a cloud is all water when the temperature is between 0 and -40° C. These data are output (TAPE7) from running FNOC PNTDAT program. An example of the ouput from this program is shown in Appendix C. The S-F program described in this manual does not use the 925 mb data. The heights are given in D-values which the program converts to absolute heights. The output is in card image format which the S-F program converts into working variables.

o <u>Cloud Input Information</u>

The observed cloud conditions are input from the AFGWC RTNEPH data tape. The documentation for this packed data tape is presented in Appendix D. For a given data point and a given cloud deck, the data provided are the height of the cloud base, height of the cloud top, cloud type, and percentage of cloud cover. In addition, there is a supplementary data word for each grid point which contains, among other information, the present weather condition from which the rain, no rain condition is obtained.

This data tape contains information for the 64 boxes shown in the figure in Appendix B. Each box contains 64 data points (8 rows by 8 columns). The progrAm converts the latitude-longitude input of the geographic data point into box, row, and column coordinates which then allows the program to find the appropriate data location on the tape. The data are then unpacked using FNOC routine BRPK.

b. Processing

The terrain height is used to specify the geometric heights (msl) of the basic cloud layers. The cloud base and top heights are used to modify the basic cloud layers to represent the specific RTNEPH cloud observations. Cloud type is used to determine whether the adiabatic or tabular approach is to be used for obtaining CMC and also whether entrainment is to be used to reduce CMC. Cloud type also specifies the parameters used in the drop-size distribution calculations. Temperature and pressure for the layers are used in the adiabatic computation of CMC. The temperature is also used in obtaining CMC from the tabular approach as well as the probability that between 0 and -40°C a cloud is all liquid. Cloud cover percentage is used as the probability of encountering the calculated CMC and drop-size distributions within the 25 x 25 n mi square box represented by one set of cloud observations on the RTNEPH tape. The cloud height information for a given cloud deck is used to compute the entrainment reduction of CMC for the adiabatic approach as well as the vertical distribution of CMC in precipitation situations.

c. Outputs

The first page or so of printouts are diagnostic printouts which should be routinely produced until the program has been run operationally for some time. After this the PRINT and WRITE statements could be left in the code with provisions introduced for including or eliminating them with an input control variable.

The microphysics output contains two basic parts, first the vertical profiles of the various moisture contents and second, the corresponding vertical profiles of cloud and precipitation particle distributions. The first output provides profiles of 1.) total condensed moisture, 2.) cloud liquid content, 3.) cloud ice content, 4.) rain liquid content, and 5.) rain ice content. In addition, the probability that the cloud water is all liquid is also provided. The probability of encountering these moisture contents within a 25 x 25 n mi square is also provided.

The outputs labeled cloud water and rain water are the drop size distributions. The units are number per cubic centimeter per one micron radius interval centered at the indicated radius value. The probability of encountering the cloud and precipitation CMC's also applies to the drop size distributions.

The stated probability that a given cloud is all liquid is interpreted as follows: if the probability is 70% and 10 clouds are sampled under these observed conditions, then seven

of these clouds would likely be all liquid and the other three would likely either be mixed liquid and ice or all ice.

The probability of encountering the output cloud conditions within the 25 x 25 n mi box is interpreted as follows: if one randomly sampled 10 times within the 25 n mi square, then, e.g., a 70% cloud cover implies that seven out of ten times the cloud conditions printed in the table would likely be observed.

SECTION 3 STAFF FUNCTIONS RELATED TO TECHNICAL OPERATIONS

3.1 Initiation Procedures

Standard FNOC procedures for running a computer program on machine HAL are to be used.

3.2 Staff Input Requirements

Fig. 1 shows an example of the JCL and input cards needed to run the PNTDAT and Smith-Feddes computer codes at FNOC. These are discussed below by card number; all cards start in column 1.

Card 1: This is the standard job card, requesting two tape drives and MS of 110000 octal to accommodate the PNTDAT program.

Cards 2-5: Standard JCL for running PNTDAT with a rewind of TAPE7, which is the output from PNTDAT.

Card 6: Standard procedure to acquire the load module for the Smith-Feddes model.

Card 7: Request card for the RTNEPH tape.

Card 8: A skip files command to skip the first two files on the RTNEPH tape.

Card 9: Request for terrain elevation tape.

Card 10: Go step.

Cards 13-26: Input cards to PNTDAT.

Card 14: Latitude and Longitude of geographic data point.

Cards 15-25: Selects the levels of data to be extracted. For details see FNOC write up of PNTDAT program.

Card 28: PRCCDE card, 0 or 1 in column five.

0 = Output of Drop Size Distribution

1 = No output of Drop Size Distribution

Card 29: Latitude and longitude of geographic data point in free format. Longitude is positive eastward, 110W=250.

Card 30: S/R RTNPH IGO card, free format.

0 = Input from RTNEPH tape

1 = Input from data card that follows (see Fig. 1b)

Card 31: S/R RTTERR IGO card, free format.

0 = Input from terrain tape

1 = Input from data card that follows (see Fig. 1b)

Card 32: S/R RDTEMP IGO card, free format

0 = Input from PNTDAT, TAPE 7

1 = Input from data cards that follow (see Fig 1b)

b. Time of Input

The RTNEPH tape provides data at three-hourly intervals. The PNTDAT program runs on the current hemispheric analysis produced at FNOC, either 0000 GMT or 1200 GMT. FNOC can generate code so that PNTDAT can be run on historical data up to

```
'JOBNAME',PE2,MS11ØØØØ,T1ØØ.                                                    1
APLIB(MT173Ø,*PNTDAT)                                                           2
LIBRARY(*FNWCLIB)                                                               3
PNTDAT.                                                                         4
REWIND,TAPE7.                                                                   5
ATTACH,LGO,SFRTALG,CY=5,ID=ZK.                                                  6
REQUEST(TAPE1,NT,PE,VSN='RTDATA TAPE',L,NORING)                                 7
SKIPF,TAPE1,2,17.                                                               8
REQUEST(TAPE2,NT,PE,VSN=41417,L,NORING) 41417 IS TERRAIN ELEVATION TAPE         9
LGO.                                                                            1Ø
7/8/9                                                                           11
COMMENT-PNTDAT INPUT                                                            12
GRID NH                                                                         13
L 5Ø.N 11Ø.W
C A1Ø Ø
C C1Ø Ø
C D1Ø Ø
C E1Ø Ø
C F1Ø Ø
C G1Ø Ø
C H1Ø Ø
C I1Ø Ø
C J1Ø Ø
C K1Ø Ø
O Ø D MB
END                                                                             26
7/8/9                                                                           27
    Ø                                                                           28
5Ø.,25Ø. COMMMENT-MATCH L IN PNTDAT INPUT,LONG. POST EASTWARD,11ØW=25Ø.         29
Ø      COMMENT- S/R RTNPH TAPE READ                                             3Ø
Ø      COMMENT- S/R RTTERR TAPE READ                                            31
Ø      COMMENT- S/R RDTEMP TAPE READ                                            32
6/7/8/9
```

Fig. 1a Job Stream for Tape Input

```
'JOBNAME',MS11ØØØ,T1ØØ.
ATTACH,LGO,SFRTALG,CY=5,ID=ZK.                                                  6
LGO.                                                                            1Ø
7/8/9                                                                           11
    Ø                                                                           28
5Ø.,25Ø. COMMMENT-MATCH L IN PNTDAT INPUT,LONG. POST EASTWARD,11ØW=25Ø.         29
1      COMMENT- S/R RTNPH CARD INPUT,2ØI4
  8Ø  8Ø 231  87  5Ø   8 21Ø 213  5Ø   5 144 177  5Ø   2  41  51
COL. 4,PRESENT WEATHER-CF. PG. 44;COL 8,VISIBILITY-CF. PG. 45
COL 12,TIME FLAG-CF. PG. 45;COL 16-TOTAL CLOUD AMOUNT,Ø-1ØØ%.
COL 2Ø,CLOUD AMOUNT Ø-1ØØ%,CF. PG. 45;COL 24,CLOUD TYPE(CODED)-TABLE 1,PG. 49
COL 28,CLOUD BASE AND COL. 32 CLOUD TOP(CODED),TABLE 2,PG. 49
ABOVE CLOUD DATA PRESENT FOR UP TO FOUR(4) CLOUD LAYERS
1      COMMENT- S/R RTTERR CARD INPUT, FREE FORMAT
73Ø
TERRAIN HEIGHT(METERS)
1       COMMENT- S/R RDTEMP CARD INPUT,F6.Ø
  163. 1549. 3159. 5799. 7448.945Ø.12Ø89.13956.16582.
PRESSURE HEIGHTS(METERS),1ØØØ,85Ø,7ØØ,5ØØ,4ØØ,3ØØ,2ØØ,15Ø,1ØØMB
  297.  29Ø.  29Ø.  277.  259.  246.  23Ø.  218.  222.  22Ø.
TEMPERATRUE(DEGREES KELVIN(K) FOR SURFACE AND 1ØØØ,85Ø,7ØØMB, ETC. AS ABOVE.
6/7/8/9
```

Fig. 1b Job Stream for Card Input

30 days old. Obviously the PNTDAT input must match, to the nearest 12-hour analysis time, the time of the RTNEPH observations.

d. Medium of Input

The PNTDAT and S-F program are currently run remotely by batch submission of cards.

Cloud data and terrain data are on magnetic tape. TAPE7 is a system disc file generated by PNTDAT.

3.2.1 Input Formats

See discussion of Fig. 1 under 3.1.

3.2.2 Composition Rules

See discussion of Fig. 1 under 3.1.

3.2.3 Input Vocabulary

See discussion of Fig. 1 under 3.1.

3.2.4 Sample Inputs

See discussion of Fig. 1 under 3.1.

3.3 Output Requirements

a.) Purpose - The S-F output is generated to obtain the vertical profiles of condensed moisture content and drop-size distribution for a particular geographic location at a particular date and time.

b.) Time - The output is randomly produced.

c.) Options - The drop-size distribution output is optional.

d.) Media - The physical form of the output is printout.

e.) Location - N/A

3.3.1 Output Formats

a.) Header - None

b.) Body - An example of the body of the printout is shown in Fig. 2. The various column headings are self explanatory and the associated variables were discussed in Section 2.7.

3.3.2 Sample Outputs

See Figure 2 in Section 3.3.1.

3.3.3 Output Vocabulary

N/A

3.4 Utilization of System Outputs

Utilization of system outputs is to be determind by NSWC.

3.5 Recovery and Error Correction Procedures

No computations are carried out if no cloud data are available on the RTNEPH tape for the geographic data point.

SECTION 4 FILE QUERY PROCEDURES

N/A

SECTION 5 TERMINAL DATA DISPLAY AND RETRIEVAL PROCEDURES

N/A

SECTION 6 TERMINAL DATA UPDATE PROCEDURES

N/A

DATA FOR LAT(N)= 50.   LON(+ EASTWARD)= 250.

LAYER	MIDPOINT HEIGHT (METERS)	TOTAL CONDENSED MOISTURE (G/M3)	CLOUD LIQUID (G/M3)	PROBABILITY CLOUD IS ALL LIQUID (PERCENT)	CLOUD ICE (G/M3)	RAIN LIQUID (G/M3)	RAIN ICE (G/M3)
1	753.	.340	0.000	0.	0.000	.340	0.000
2	799.	.340	0.000	0.	0.000	.340	0.000
3	867.	.340	0.000	0.	0.000	.340	0.000
4	974.	.340	0.000	0.	0.000	.340	0.000
5	1117.	.340	0.000	0.	0.000	.340	0.000
6	1350.	.957	.618	100.	0.000	.340	0.000
7	1741.	0.000	0.000	0.	0.000	0.000	0.000
8	2516.	0.000	0.000	0.	0.000	0.000	0.000
9	3659.	0.000	0.000	0.	0.000	0.000	0.000
10	4284.	0.000	0.000	0.	0.000	0.000	0.000
11	4800.	1.134	.731	49.	0.000	0.000	.402
12	6614.	0.000	0.000	0.	0.000	0.000	0.000
13	8463.	0.000	0.000	0.	0.000	0.000	0.000
14	9450.	.093	0.000	0.	.060	0.000	.033

LAYER	PROBABILITY OF ENCOUNTERING ABOVE CLOUD AND PRECIP IN 25 X 25 N. MI. BOX
1	0.
2	0.
3	0.
4	0.
5	0.
6	50.
7	0.
8	0.
9	0.
10	0.
11	50.
12	0.
13	0.
14	50.
15	0.

CLOUD WATER - LIQ

LYR \ R-	2.5	7.5	12.5	17.5	22.5	27.5	32.5	37.5
6	22.23211	21.94052	13.89116	8.94255	6.02119	4.22345	3.06547	2.28890
11	56.31626	91.68997	19.43133	3.96033	.91103	.23839	.06992	.02261

CLOUD WATER - ICE

LYR \ R-	2.5	7.5	12.5	17.5	22.5	27.5	32.5	37.5
14	0.00000	.23088	.12715	.06655	.03875	.02447	.01641	.01152

RAINWATER - LIQ

LYR \ R-	150.	450.	750.	1050.	1350.	1650.	1950.	2250.	2550.	2850.
1	8.17220	1.36445	.22781	.03804	.00635	.00106	.00018	.00003	.00000	.00000
2	8.17220	1.36445	.22781	.03804	.00635	.00106	.00018	.00003	.00000	.00000
3	8.17220	1.36445	.22781	.03804	.00635	.00106	.00018	.00003	.00000	.00000
4	8.17220	1.36445	.22781	.03804	.00635	.00106	.00018	.00003	.00000	.00000
5	8.17220	1.36445	.22781	.03804	.00635	.00106	.00018	.00003	.00000	.00000
6	8.17220	1.36445	.22781	.03804	.00635	.00106	.00018	.00003	.00000	.00000

RAINWATER - ICE

LYR \ R-	150.	450.	750.	1050.	1350.	1650.	1950.	2250.	2550.	2850.
11	8.48081	1.52494	.27420	.04930	.00887	.00159	.00029	.00005	.00001	.00000
14	4.02557	.16309	.00661	.00027	.00001	.00000	.00000	.00000	.00000	.00000

Fig. 2 Sample Output

REFERENCES

AFGWC/TSIT, 1983: RTNEPH Data Base Specification.

Brown, E., 1983: Observations Concerning CLOUDC (Smith-Feddes) Model, Letter of Transmittal, Contract No. N60921-81-C-A235 (A007) 23 June 1983. EG&G Washington Analytical Services Center, Inc., P.O. Box 552, Dahlgren, VA 22448.

Dykton, M., S. Grimes and B. Hampton, 1984: Program CLOUDC Source Code, February 1984. EG&G Washington Analytical Services, Inc., P.O. Box 552, Dahlgren, VA, 22448.

Feddes, R.G., "A Technique to Specify Liquid Water Content at a Point in the Atmosphere," USAFETAC Project 6988, USAFETAC, Washington, D.C., 1973, (unpublished).

Feddes, R.G., "A Synoptic-Scale Model for Simulating Condensed Atmospheric Moisture," USAFETAC, Washington, D.C., June 1974.

Rogers, C.W., J.T. Hanley and E.J. Mack, 1985: "Updating the Smith-Feddes Model-Final Report". Contract No. N00228-84-C-3157, June 1985. Calspan Corporation, P.O. Box 400, Buffalo, N.Y. 14225.

APPENDIX A

PNTDAT INPUT

ANNEX A

GENERAL DESCRIPTION OF INPUTS

Inputs to the program are in the form of directives as defined below:

GRID DIRECTIVE	Defines one of five FNWC grids from which data are to be retrieved.
LATITUDE LONGITUDE DIRECTIVE	Defines geographic locations where data are desired.
CATALOG DIRECTIVE	Defines a parameter to be retrieved in terms of a 3 character identifier.
OPTION DIRECTIVE	Defines optional parameters to be derived.
SECURITY DIRECTIVE	Defines and inhibits output classification.
END	Terminates an input directive group.

The input directives are subdivided into input groups. An input group may have directives for one, and only one, unique grid. For example, if a requestor desires data from the polar-stereographic grid (Northern Hemisphere) and from the global band grid, he must specify two input groups and terminate each with an END directive.

In the discussion of the input directives below, the following notation applies: items enclosed in brackets [ ] are optional; if an optional item is selected, the item that follows, which is enclosed by parentheses ( ), must follow. Also, the directives are free-field; i.e., there may

be any number of leading and trailing blanks separating any field. All numeric fields may be specified with, or without, a decimal to any desired accuracy; however, no field may exceed 10 characters. Optional parameters are order-independent; other parameters must be specified in the indicated order.

a. Grid Directive.

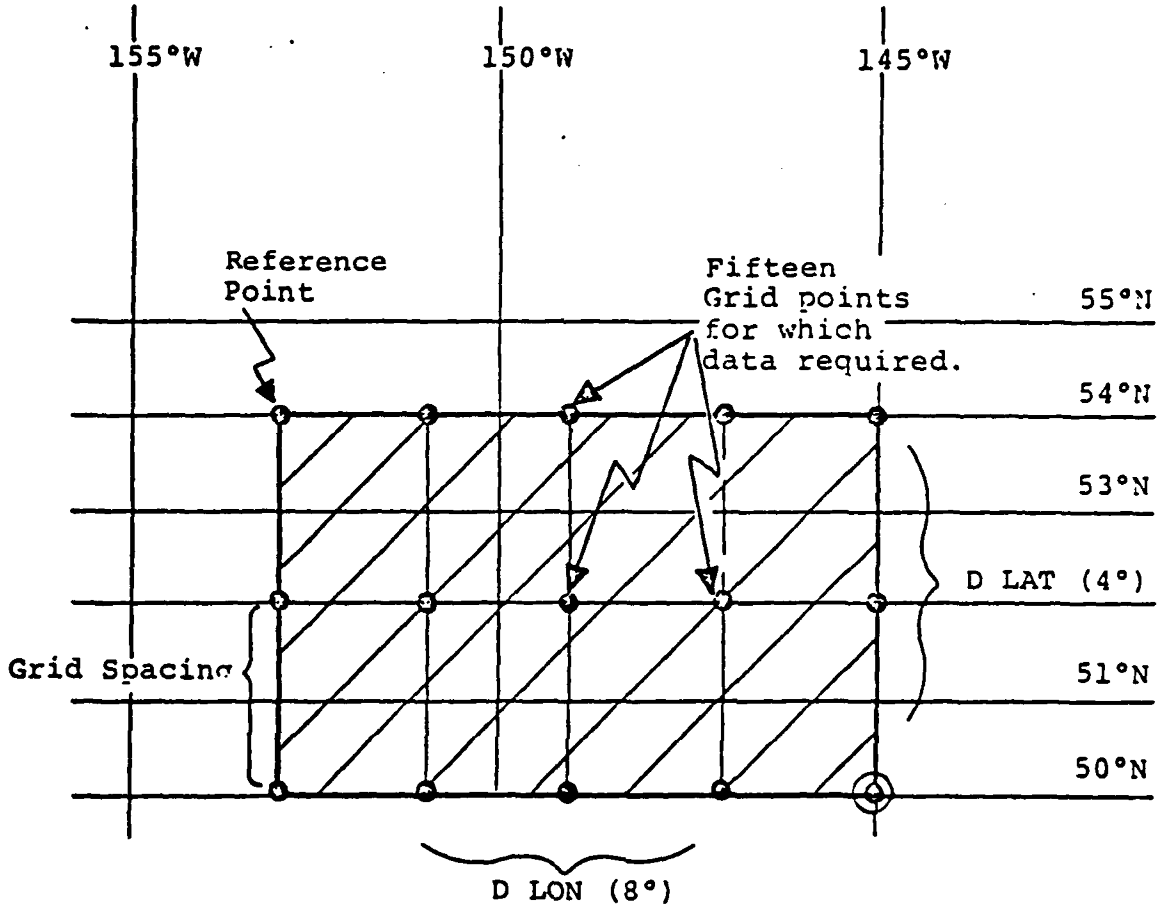
[GRID] (G)

GRID	Grid directive descriptor (if specified must be first directive in group)
G	Allowable values of G are: NH Polar Stereographic - Northern Hemisphere (default) SH Polar Stereographic - Southern Hemisphere MED Polar Stereographic on the Mediterranean GB Global Band G Global

b. Latitude/Longitude Directive.

$$L\ LAT\binom{N}{S}\ LONG\binom{E}{W}\ [DLAT\ DLON]\ [DGRID]$$

L	Latitude longitude directive descriptor
LAT	Latitude in degrees
$\binom{N}{S}$	North/South direction indicator
LON	Longitude in degrees
$\binom{E}{W}$	East/West direction indicator
DLAT	Specifies length (in degrees) of an optional area in the north/south direction. See Figure A-4.
DLON	Specifies length (in degrees) of an optional area in the east/west direction. See Figure A-4.
DGRID	Specifies sub-grid spacing (in degrees) of the optional area. Default is 2.5 degrees. The program treats each point on the sub-grid as if it were specified in a latitude/longitude directive. See Figure A-4.



Example of area option as encoded by L $\underbrace{\text{54N 153W}}_{\text{Ref. Pt.}}$ $\underset{\text{DLAT}}{4}$ $\underset{\text{DLON}}{8}$ $\underset{\text{SPAC}}{2}$

Note: Reference point is <u>always</u> in NW corner of grid.

FIGURE A-1: POINTDAT GRID STRUCTURE AND ORIENTATION

c. Catalog Directives (Standard)

C CAT(F) TAU [NSTD] (LEV) [MB]

C	Catalog directive descriptor.
CAT(F)	3-character catalog directive and optional flaps character.
TAU	$0 \leq$ TAU ≤ 999. TAU must be modulo 6.
NSTD	Non-standard option overrides level in CATF
LEV	The desired non-standard level - default in feet.
MB	If selected, LEV is in millibars.

d. Option Directives (PNTDAT Derived).

1. Shear:

```
            H
O TAU SH V [L] (LEV1 LEV2) [I] (INT) [MB]
            B
```

O	Option directive descriptor.
SH	Shear option.
H	Horizontal shear only.
V	Vertical shear only.
B	Vertical and horizontal shear.
I	Interval option. Default interval is 1000 feet.
INT	Interval (5 = 5000 feet).
L	Level option. Default is SFC to 100,000 feet.
LEV1	Base level.
LEV2	Top level.
MB	Standard levels overrides I option.

2. D-Value

O TAU D [L] (LEV1 LEV2) [I] (INT) [MB]

D	D-Value option.
I	Same as (a) above. Default is 1000 feet.
INT	Same as (a) above.
L	Same as (a) above. Default is SFC - 20,000 feet.
LEV1	Same as (a) above.
LEV2	Same as (a) above.
MB	Same as (a) above.

3. Wind

O TAU W [L] (LEV1 LEV2) [I] (INT) [MB]

W	Wind option.
I	Same as (a) above. Default is 1000 feet.
INT	Same as (a) above.
L	Same as (a) above. Default is SFC - 20,000 feet.
LEV1	Same as (a) above.
LEV2	Same as (a) above.
MB	Same as (a) above.

4. Pressure-Density Altitude

O TAU P (LEV)

P	Pressure/Density altitude option.
LEV	Height in feet.

d. Security Directive.

[U] (C)

U	Upgrade directive descriptor.
C	Defines classification labeling on output.
	U Unclassified - Default
	C Confidential
	S Secret
	N NATO

Classification may be upgraded to level requested, however, it may not be downgraded to that level.

END DIRECTIVE

END	Terminates an input group of directives.

APPENDIX B

TERRAIN TAPE FORMAT

-----TERRAIN-GEOGRAPHY TAPE DOCUMENTATION-----

TAPE FORMAT: THERE ARE TWO TAPES, ONE FOR THE NORTHERN HEMISPHERE AND ONE FOR THE SOUTHERN HEMISPHERE.

RECORD LENGTH---- EACH RECORD IS COMPOSED OF 392 ASCII CHARACTERS.

RECORD CONTENT--- EACH RECORD CONTAINS ONE 1/8 MESH BOX-J. 64 RECORDS COMPRISE ONE 1/8 MESH BOX.

FIRST 8 CHARACTERS OF THE RECORD CONTAIN THE RECORD ID (BOX NUMBER & J)

CHARACTER #'S	LABEL
1	BLANK
2-4	BOX 002-063 N.HEM 102-163 S.HEM
5-6	BLANK
7-8	J 1-64

BYTES 9 THROUGH 392 CONTAIN DATA FOR 64 GRID POINTS

EACH GRID POINT CONTAINS THE FOLLOWING INFORMATION:

# OF CHARACTERS	DESCRIPTION
1	GEOGRAPHY INDICATOR 1=WATER 2=LAND 3=ICE 4=COAST 9=OFF-HEMISPHERE
2	TIME ZONE INDICATOR 16 TIME ZONE INDICATORS EACH ZONE IS 22.5 DEGREES IN LONGITUDE WIDE.
3	ELEVATION IN DECAMETERS

NOTE: A MAP OF THE TIME ZONES FOR BOTH NORTHERN & SOUTHERN HEMISPHERES IS INCLUDED.

Program No.	ELECTRONIC DATA PROCESSING	Tape Deck No.	CL-Part Step
Machine Type	TAPE DATA LAYOUT SHEET	Serial No.	Format No

TERRAIN - GEOGRAPHY TAPE FORMAT.

32 BIT WORDS - ASCII CHARACTERS
RCD LENGTH - 392 BYTES
BLK LENGTH - 392 BYTES

TERRAIN-GEOGRAPHY DATA

FIELD NO	RCD ID		I1			I2			— — —	I63			I64		
NAME	BOX	J	GEO	TIME ZONE	ELEV	GEO	TIME ZONE	ELEV	— — —	GEO	TIME ZONE	ELEV	GEO	TIME ZONE	ELEV
VALUE															
LOCATION	1 4	6 8	9	11	14	15	17	20	380		383	386		389	392

GEO - GEOGRAPHY INDICATOR 1-4, 9
TIME ZONE INDICATOR 0-15, 99
ELEV - IN DECAMETERS 0-998, 999

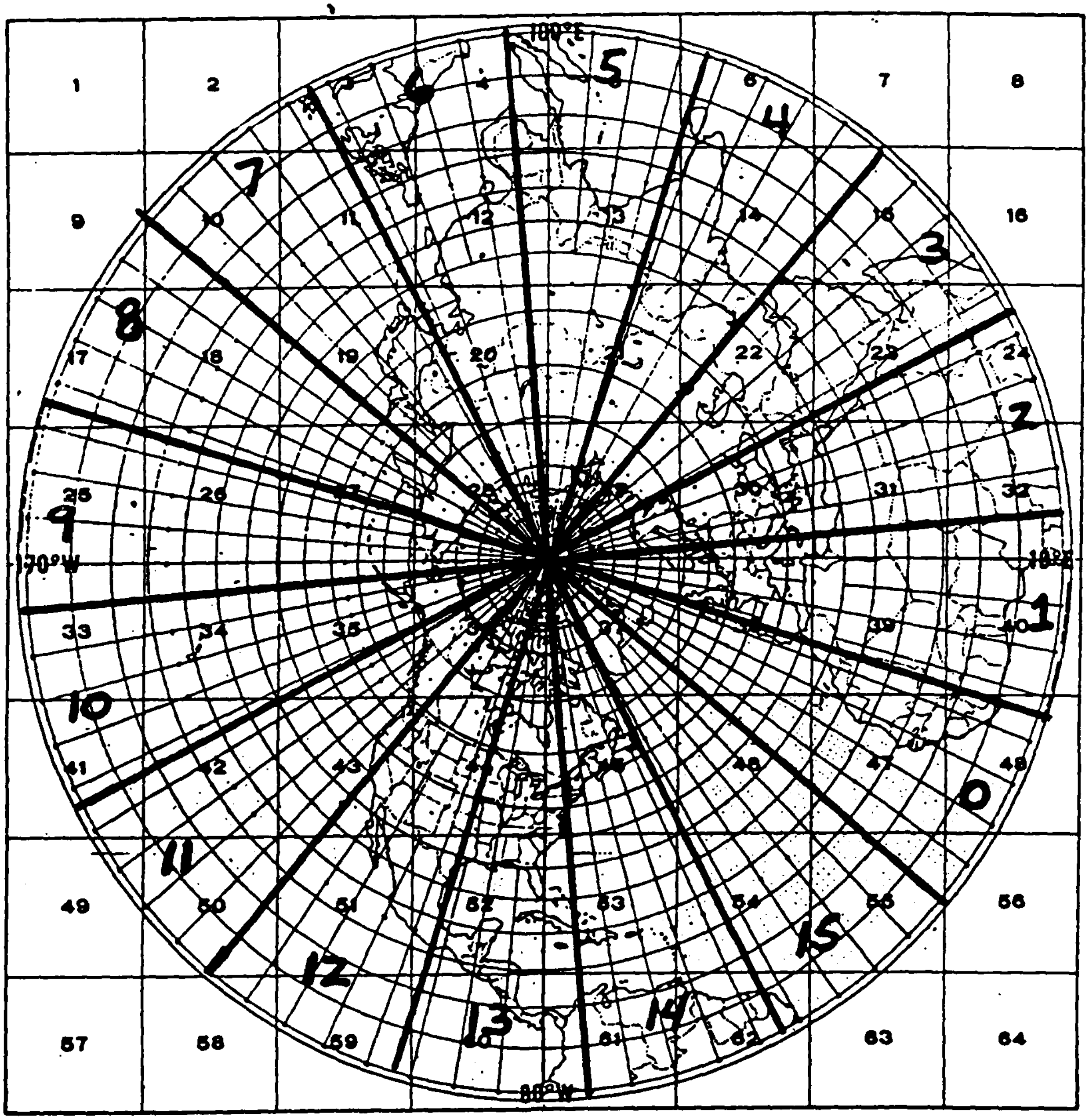
FIELD NO	
NAME	
VALUE	
LOCATION	

FIELD NO	
NAME	
VALUE	
LOCATION	

FIELD NO	
NAME	
VALUE	
LOCATION	

Remarks	Change	Date	Page

TERRAIN-GEOGRAPHY TAPE TIME ZONES



NORTHERN HEMISPHERE

APPENDIX C

PNTDAT OUTPUT

```
FIELD T   AIR      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -25.0
FIELD T  1000      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -47.4
FIELD T   850      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -32.9
FIELD T   700      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -25.2
FIELD T   500      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -41.3
FIELD T   400      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -49.2
FIELD T   300      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -55.3
FIELD T   200      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -46.9
FIELD T   150      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -49.4
FIELD T   100      0 HR ANAL FROM 85013112      (C)
LAT         LON         VALUE          LAT        LON        VALUE
 50.0N      110.0W       -53.7
D VALUES   LAT/LON    50.0N/110.0W     0 HR ANAL FROM 85013100
 1000.MB      263.    925.MB     111.   850.MB    -196.   700.MB    -566.
  500.MB    -1296.    400.MB   -1741.   300.MB   -2198.   250.MB   -2255.
  200.MB    -2113.    150.MB   -1926.   100.MB   -1699.    50.MB   -1568.
   30.MB    -1695.     10.MB   -2173.
```

Sample output from Program PNTDAT. First 37 lines of printout are temperature profil

Values are for surface and standard pressure levels, 1000mb, 850mb, etc.

Bottom portion contains D-values for standard pressure levels in feet. Reference

heights can be found in FNWC Computer User Guide, Table 4.2.

APPENDIX D

RTNEPH

DATA BASE SPECIFICATION

AFGWC/TSIT

1 March 1983
Revised 1 December 1983

DATA BASE SPECIFICATION

TABLE OF CONTENTS

DATA BASE SPECIFICATIONS
SUMMARY OF REVISIONS

1 Dec 83 Corrected typos

Corrected range of cloud type in Atch 3.1 to 0-35 (previously 0-25)

Corrected Atch 3.7 (RAREAs) to indicate word 71 (sector 0) is RAREA number

Corrected Atch 3.13 to reflect sectors 1188-1379 for whole mesh information (vice previous 1188-1389).

SECTION 1. GENERAL.

1.1 Purpose of the Data Base Specification. The objective of this Data Base Specification is to describe the storage allocation and data base organization for the Realtime Three-Dimensional Nephanalysis (RTNEPH). Additionally, it will provide the basic design for the construction of the system files, tables, and directories.

1.2. Project Reference. The RTNEPH Automated Data System (ADS) will process meteorological satellite imagery and conventional observations to produce, in near realtime, an automated global analysis of clouds and sensible weather. The output from the ADS will be used to initialize cloud forecasting models, to verify cloud forecasts, to provide a simulation data base, and to serve a number of related purposes for AFGWC, USAFETAC, and other users.

a. Functional Description, Mar 83, A Realtime Automated Cloud Analysis System.

b. Subsystem Specifications.

1. RTNEPH Satellite Processor Subsystem Specification, 18 Sep 81.

2. RTNEPH Conventional Processor Subsystem Specifications, 10 Nov 81.

3. RTNEPH Merge Processor Subsystem Specifications, 1 Mar 83.

4. RTNEPH Bogus Processor Subsystem Specifications, 15 Apr 82.

1.3 Terms and Abbreviations. See Ref 1-2a.

LABEL—A subdivision of a literal (see below).

LITERAL—A name used to identify a particular data base in the AFGWC data base. For example, XRTNOR is the literal for the N. Hemisphere synoptic RTNEPH data base. The literal is further divided into labels; e.g., 00SC15 would be the label containing RTNEPH box 15 information.

UNIVAC word—when data is packed into UNIVAC's 36 bit word only 32 bits are used to emulate the 32 bit word structure. The UNIVAC word's bits are numbered from the Most Significant Bit (MSB) to the Least Significant Bit (LSB), 1 through 36.

When a parameter requires 32 bits then bits 5 thru 36 are used.

When parameters are packed as half words (16 bits) then the first half word is in bits 3-18 and the second half word is in bits 21-36.

When parameters are packed into quarter words (8 bit bytes) then:

byte 1 = bits 2-9
byte 2 = bits 11-18
byte 3 = bits 20-27
byte 4 = bits 29-36

When data is packed into sub-byte formats the bits within the bytes are numbered 1-8 from the MSB thru LSB. Figure 1 shows how the UNIVAC word is broken up into quarter words and bytes. The corresponding UNIVAC bit is shown on the bottom.

Q1 BYTE 1	Q2 BYTE 2	Q3 BYTE 3	Q4 BYTE 4
012345678	012345678	012345678	012345678
	111111111	122222222	223333333
123456789	012345678	901234567	890123456

Figure 1

In the following descriptions of packed information, UNIVAC bits are shown in parentheses.

SECTION 2. DATA BASE IDENTIFICATION AND DESCRIPTION

2.1 Data Base Identification.

2.1.1 System Using the Data Base. The system creating all data bases described in this Data Base Specification is described in the Functional Description (Ref 1.2a). The programs and systems which will use the various data bases include the RTNEPH itself, the 5LAYER and HRCP cloud forecast models, along with a multitude of applications programs and simulators not actually run at AFGWC. Those latter, non-AFGWC, users will depend on analysis data archived on magnetic tape and will not access the RTNEPH data bases directly. See Appendix I.

2.1.2 Effective Dates. Most of the data bases described in this document are currently in use with the present 3DNEPH ADS. The effective date for implementation of the RTNEPH and subsequent application of all data bases described here will be 1 Aug 1983.

2.1.3 Storage Requirements. See Appendix I for a table showing storage requirements of each data base. The RTNEPH ADS itself will require 5670 tracks of mass storage and will use a maximum of 90 K words of core when operating.

2.1.4 Physical Description of Data Base Files. Appendix I will describe each data base file.

2.2 Labeling/Tagging Conventions. Not Applicable.

2.3 Organization of the Data Base. All data base files described in this document will reside on disk. All files will be partial-word packed to conserve mass storage. Those new files developed for the RTNEPH will be quarter- or half-word addressable and will use no more than 8 bits of a quarter-word or 16 bits of a half-word. The format of those files used by the present 3DNEPH ADS and other programs operational at AFGWC will not change.

2.4 Special Instructions. Data will be entered into these data bases only by the System Software, with the exception of "bogus" analysis data, which will be man-computer interactively generated and entered into the final analysis data base. Instructions for accessing those data base files available to users outside AFGWC will be described in user documentation.

2.5 Support Programs Available for Handling the Data Base. Numerous AFGWC and UNIVAC programs are available for handling and accessing the data base. These programs are described in detail in UNIVAC and AFGWC System documentation.

2.6 Security and Privacy. All data, input and output, will be unclassified, except when analyses are generated on computer System III/R. In this case, output data will not be made available outside the classified area without WS and IN permission.

SECTION 3. DATA DEFINITIONS.

All data files, tables, and items are fully described in attachments 3.1 though 3.13.

SECTION 4. INTEGRATED DATA BASE

Does not apply to the RTNEPH.

FILE NAME/LITERAL	CONTENTS	USED BY	MASS STORAGE REQUIREMENTS
AFGWC*DATMANXNNEFA (N. Hemisphere) AFGWC*DATMANXSNEFA (S. Hemisphere)	Eighth-mesh analyses of cloud heights and amounts, present weather, surface visibility	Cloud forecast model	963 tracks per hemisphere
AFGWC*DATMANXRTNOR (N. Hemisphere) AFGWC*DATMANXRTSOU (S. Hemisphere)	Eighth-mesh analyses of cloud heights and amounts, present weather, surface visibility	Cloud forecast model	1926 tracks per hemisphere
RTNEPH*BACKBRIGHT	Satellite background brightness values and control information for Northern and Southern Hemisphere	Satellite Processor, Snow Analysis	127 tracks
RTNEPH*NHSATELLITE RTNEPH*SHSATELLITE	RTNEPH satellite analyses	Merge Processor	1024 tracks per hemisphere
RTNEPH*NHREPORTS RTNEPH*SHREPORTS	"Best Reports"— gridded surface reports, interpolated to eighth-mesh	Merge Processor	60 tracks-N.H. 40 tracks-S.H.
AFGWC*DATMANXFIX64	Northern and Southern Hemisphere temperature and geography fields	Satellite Processor	570 tracks
RTNEPH*INTERP	Satellite processing parameters	Satellite Processor	2 tracks
RTNEPH*RAREA1 RTNEPH*RAREA2 RTNEPH*RAREA3 RTNEPH*RAREA4 RTNEPH*RAREA5 RTNEPH*RAREA6	Predominant data times and count for use by cloud forecasting models. Control information	Cloud forecast models, Bogus Processor	1 track per file
RTNEPH*NHQOINFO RTNEPH*SHQOINFO	Quarter orbits to be processed	Satellite Processor	1 track per hemisphere
RTNEPH*NHWMINFO RTNEPH*SHWMINFO	Whole mesh boxes to be processed	Satellite Processor	3 tracks per hemisphere
RTNEPH*TEMPS	Hemispheric upper air temperature and heights	Satellite Processor	46 tracks
RTNEPH*MERGE	Tuning parameters for the Merge Processor	Merge Processor	1 track

FILE NAME/LITERAL	CONTENTS	USED BY	MASS STORAGE REQUIREMENTS
RTNEPH*TOTCLDFILE	RAREA Information plus total cloud for Pre-Bogus display software	Merge Processor, Bogus Software	56 tracks
RTNEPH*WORKFILE	RTNEPH Processing Information	RTNEPH DRIVER	25 Tracks

Appendix I-1

FILE NAME: AFGWC*DATMANXNNEFA (Northern Hemisphere)
AFGWC*DATMANXSNEFA (Southern Hemisphere)

LITERAL: XNNEFA the Northern Hemisphere
XSNEFA The Southern Hemisphere

LABELS: 00SCXX, where XX is the RTNEPH box number (XX = 02, 03, . . ., 63; excluding 08 and 57)

CONTENTS: Eighth-mesh gridded analysis of cloud heights and amounts, present weather, and visibility. Cloud layers may overlap therefore each layer will have its own base and top. Layers are sorted according to base height from the top of the atmosphere down. Therefore Layer 1 will always have the highest cloud base. For clear situations words 3-6 will always be zero. All layers after an initial layer which is zero-filled must have their parameters equal to zero. Data for all off-the-world grid points will be zero filled.

FILE LENGTH: 963 tracks per literal; 28756 words per label.

FILE FORMAT:

Words 1 through 28736 of each label contain the gridded analysis, seven (7) words per gridpoint. These words will be grouped in the following manner:

Words 1-4096	All word 1s for a neph box.
Words 4097-4116	Words 28737-28756 copied here for convenience of other users of data base.
Words 4117-8212	All word 2s for a neph box.
Words 8213-8232	Buffer words.
Words 8233-12328	All word 3s for a neph box.
Words 12329-16424	All word 4s for a neph box.
Words 16425-20520	All word 5s for a neph box.
Words 20521-24616	All word 6s for a neph box.
Words 24617-24640	Buffer words.
Words 24641-28736	All word 7s for a neph box.
Words 28737-28756	Control words.

The format of the seven words is as follows:

WORD	BYTE	PARAMETER	VALUE
1	1	Present weather	0-99, WMO Code 4677

Attachment 3.1

WORD	BYTE	PARAMETER	VALUE
	2	Visibility	0-99, WMO Code 4377
	3	Time flag	0-229, hours before Julian reference time (JRT). 230, more than 229 hours before JRT 231-254, hours after JRT -230. 255, more than 24 hours after JRT
	4	Total cloud amount	0-100%
2		Source flags for cloud layers. When the bit is on, (1), the respective source of data was used to analyze the layer. For clear conditions all bits are off. The following bits represent the specific data source. Bit Purpose 1—Low cloud persisted 2—Cloud base was estimated 3—Cloud top was estimated 4—Best report from RAOB data 5—Best report from PIREP data 6—Best report from surface data 7—Visual satellite data 8—IR satellite data	
	1	This byte contains the source flags for the first cloud layer.	
	2	Source flags for layer 2	
	3	Source flags for layer 3	
	4	Source flags for layer 4	
3	1	Cloud amount—layer 1	0-103; 5% increments; additional 1% indicates thin cloud; additional 2% indicates cloud layer derived from merging 2 cloud decks.
	2	Cloud type—layer 1	0-35 (See Table I)
	3	Cloud base—layer 1	0-255 (See Table II) height MSL

WORD	BYTE	PARAMETER	VALUE
	4	Cloud top—layer 1	0-255 (See Table II) Height MSL
4	1	Cloud amount—layer 2	0-103; 5% increments; additional 1% indicates thin cloud; additional 2% indicates cloud layer derived from merging 2 cloud decks.
	2	Cloud type—layer 2	0-35 (See Table I)
	3	Cloud base—layer 2	0-255 (See Table II)
	4	Cloud top—layer 2	0-255 (See Table II)
5	1	Cloud amount—layer 3	0-103; 5% increments; additional 1% indicates thin cloud; additional 2% indicates cloud layer derived from merging 2 cloud decks.
	2	Cloud type—layer 3	0-35 (See Table I)
	3	Cloud base—layer 3	0-255 (See Table II)
	4	Cloud top—layer 3	0-255 (See Table II)
6	1	Cloud amount—layer 4	0-103; 5% increments; additional 1% indicates thin cloud; additional 2% indicates cloud layer derived from merging 2 cloud decks.
	2	Cloud type—layer 4	0-35 (See Table I)
	3	Cloud base—layer 4	0-255 (See Table II)
	4	Cloud top—layer 4	0-255 (See Table II)
7		Diagnostic word—this word provides flags which indicate significant decisions made during the analysis	

BYTE	BIT	PARAMETER
1	1	Bogus Flag—this point contains Bogus information. For AFGWC use only. This bit is zeroed in the archived data base.
	2	Best Report Flag—a conventional report was included in this point.
	3	Spread Data—data from a best report was spread into this point.
	4	Visual Satellite data was included in this analysis.

BYTE	BIT	PARAMETER
	5	IR data was included.
	6	Low level cloud has been persisted past normal data cutoff time.
	7	Identifies that although the visual satellite said cloudy, the point is marked clear for lack of other data.
	8	Fog/Haze present but superceded by other weather elements in word 1.
2	1-3	Time of oldest data for that grid point (HROLDR).
	4-8	Not used.
3	1	Not used.
	2	The "Best Report" contained RAOB data.
	3	The "Best Report" contained PIREP data.
	4	The "Best Report" contained surface observations.
	5	ICE—water point was iced over.
	6	SNOW—the snow flag was set.
	7	Tropics—the point was in the tropics.
	8	IR daylight Q.O.—this IR Q.O. was in daylight.
4	1	IR sun-side—this point was on the sunward side of the IR Q.O.
	2	Visual Daylight Q.O.—this visual Q.O. was in daylight.
	3	Visual sun-side—the visual data was on the sunward side of the visual Q.O.
	4	Sunglint—the visual data fell in the sunglint cone.
	5-6	IR satellite—the IR satellite ID minus 1. This is an internal ID (1 thru 4) used to select tuning parameters.
	7-8	Visual satellite—the visual satellite ID minus 1.

Words 28737-28756 are control words containing the following information.

WORD	CONTENTS
28737	Julian reference time (Bits 5-36)
28738	Zero
28739	Zero
:	Zero
28752	Label name (Field data)
28753	Julian hour of label set to the value '1'
28754	Zero
28755	Zero
28756	Zero

The Julian reference time will be updated at each synoptic time. Therefore it will be a multiple of three. The time flag is the time of the most recent piece of information for that grid point therefore, the analysis time of any grid point can be obtained by adding the time flag to the Julian reference time. The Julian hour of label is fixed at "1" because the data base is continuously updated. Therefore its access or update interval has to be equal to or less than an hour.

The time of any data point is obtained as follows:

TF = time flag (0, 1, ... 255)
JRT = Julian Reference Time
DT = data time for a given point

DT = JRT - TF, if TF less than or equal to 230
= JRT+TF-230 otherwise

This data time reflects the latest (i.e., most current) time going into the data point. There can be older data in the point. Given the HROLDR (hours oldes flag) in word 7 of the analysis, the time of the older data (OLDDT) is:

OLDDT = DT - HOLDR

Attachment 3.1-6

TABLE I. CLOUD TYPES

Code Value	Cloud Type
0	Clear
1	Cumulonimbus (CB)
2	Stratus (ST)
3	Stratocumulus (SC)
4	Cumulus (CU)
5	Altostratus (AS)
6	Nimbostratus (NS)
7	Altocumulus (AC)
8	Cirrostratus (CS)
9	Cirrocumulus (CC)
10	Cirrus (CI)
25	Unknown

If all four RTNEPH layers contain cloud and a ground based layer of fog is located beneath the lowest reported cloud deck, the RTNEPH will indicate this fog by adding 10 to the cloud type of layer 4. the lowest layer.

TABLE II. CLOUD HEIGHTS

The RTNEPH will use the following code to report cloud heights above mean sea level (MSL).

Code Values	Definitions
0-200	30 meter increments for 0-6000 meters MSL.
201-253	300 meter increments for 6300-21900 meters MSL. MSL HGT = (Code - 200) X 300 +6000.
254	Greater than 21900 meters
255	Height not available.